

## THREE NEW GENERA OF SMALL MINNOW MAYFLIES (INSECTA: EPHEMEROPTERA: BAETIDAE) FROM THE ANDES AND PATAGONIA

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### ABSTRACT

Three new genera and three new species of Baetidae (Insecta: Ephemeroptera) are described from the Andes and Patagonia. Larvae of *Andesiops*, new genus, are distinguished by the apically bifid right prosthema and two rows of denticles on the tarsal claws. Larvae of *Deceptiviosa*, new genus, are distinguished by the apically bifid right prosthema and small subapical denticle on the tarsal claws. Larvae of *Nanomis*, new genus, are distinguished by the apically acute maxillary palp segment 2, smooth posterior margin of the terga, and paddle-shaped subapical seta on the hindtibiae. Adults of *Andesiops* and *Deceptiviosa* are similar, but distinguished from other South American baetids by having hindwings with a small costal process in the basal one third and three longitudinal veins with the middle vein being forked, and an elongate and ellipsoidal genital forceps segment 3. Larvae and adults of *Andesiops peruvianus*, new combination, are redescribed, and additional locale data are provided for Argentina, Bolivia, Ecuador, and Venezuela. *Deceptiviosa ardua*, new species, is described from larvae from Chile, and *D. torrens*, new species, is described from larvae and adults from Chile and Argentina. *Nanomis galera*, new species, is described from larvae from Argentina, Colombia, Ecuador, and Peru.

**KEYWORDS:** *Andesiops*, *Deceptiviosa*, *Nanomis*, Ephemeroptera, Baetidae.

### INTRODUCTION

South American small minnow mayflies (Insecta: Ephemeroptera: Baetidae) have received considerable attention recently as part of an intensive effort to document their diversity and hypothesize their relationships (Lugo-Ortiz & McCafferty, 1994, 1995, 1996 abcd, 1997, 1998). The following genera are currently known from South America: *Adebrotus* Lugo-Ortiz & McCafferty, *Americabaetis* Kluge, *Apobaetis* Day, *Aturbina* Lugo-Ortiz & McCafferty, *Baetodes* Needham & Murphy, *Bernerius* Waltz & McCafferty, *Callibaetis* Eaton, *Camelobaetidius* De-

moulin, *Cloeodes* Traver, *Cryptonympha* Lugo-Ortiz & McCafferty, *Guajirolus* Flowers, *Harpagobaetis* Mol, *Mayobaetis* Waltz & McCafferty, *Moribaetis* Waltz & McCafferty, *Paracloeodes* Day, *Prebaetodes* Lugo-Ortiz & McCafferty, *Rivudiva* Lugo-Ortiz & McCafferty, *Spiritiops* Lugo-Ortiz & McCafferty, *Tomodontus* Lugo-Ortiz & McCafferty, *Varipes* Lugo-Ortiz & McCafferty, *Waltzoyphius* McCafferty & Lugo-Ortiz, and *Zelusia* Lugo-Ortiz & McCafferty. South American reports of *Baetis* Leach and *Cloeon* Leach are based on outdated generic concepts and may be presumed to be incorrect based on comprehensive biogeographic analyses of the Ephemeroptera of the Western Hemisphere (e.g., McCafferty et al., 1992; McCafferty, 1998), and those of *Pseudocloeon* Klapálek require revision because the concept of that genus has been based on the

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Oriental species *P. kraepelini* Klapálek (Waltz & McCafferty 1985).

Knowledge of Baetidae in South America is almost exclusively confined to tropical and subtropical lowland areas. Andean and temperate baetids have been considerably less documented. Herein, we describe three new genera and three new species of Baetidae mainly from the Andean highlands and Patagonia. One of the new genera consists of one species previously placed under *Baetis*; its larval and adult stages are redescribed herein. Locale data for type materials are provided in full. Locale data for additional materials are provided in short form, and include country, province or state, and river system or closest settlement. The complete locale data for the latter are available from the authors upon request. Except where otherwise specified, the material examined is housed in the Purdue Entomological Research Collection (PERC), West Lafayette, Indiana, USA.

#### *Andesiops* Lugo-Ortiz & McCafferty, new genus

##### Larva

**Head:** Capsule longer than broad. Labrum (Fig. 1) wider than long, broadly rounded anteriorly, with narrow anteromedial emargination. Hypopharynx (Fig. 2). Left mandible (Fig. 3) with one set of incisors; prostheca robust, apically denticulate. Right mandible (Fig. 4) with two sets of incisors; prostheca apically bifid. Maxillae (Fig. 5) with four short, blunt denticles on crown of galealaciniae; palps two segmented, reaching galealaciniae; palp segment 2 apically rounded. Labium (Fig. 6) not compact, with palps three segmented; palp segment 2 distomedially produced; palp segment 3 narrowly rounded.

**Thorax:** Nota without setae medially. Legs (Fig. 7) robust; femora without villopore and with dorsal row of long, fine, simple setae; tibiae and tarsi without dorsal row of long, fine, simple setae; hindtibiae without subapical paddle-shaped seta; tarsal claws with two rows of denticles (Fig. 59).

**Abdomen:** Slightly dorsoventrally flattened. Terga (Fig. 8) with abundant scales and scale bases; creases absent; posterior margin with triangular spines. Sterna (similar to Figs. 39, 40) with anterolateral friction pads. Gills (Figs. 9, 10) on segments 1–7, platelike, relatively broad, marginally with small serrations and minute, simple setae, untracheated or poorly tracheated, held dorsolaterally. Paraprocts

(Fig. 11) with marginal spines. Cerci with abundant setae laterally and medially; medial caudal filament approximately 0.65–0.70× cerci length, with abundant fine, simple setae laterally.

##### Adult

**Head:** Turbinate eyes (Figs. 12, 13) broadly based, ellipsoidal.

**Thorax:** Forewings (Fig. 14) anastomosed subapically between costa and subcosta. Hindwings (Fig. 15) with three longitudinal veins, middle vein forked; small costal process in basal 1/3.

**Abdomen:** Male genital forceps (Fig. 16) three segmented; segment 1 short, subcylindrical; segment 2 long, arched; segment 3 ellipsoidal, approximately 0.48× length of segment 2. Caudal filaments approximately 2.78–3.0× body length.

##### Etymology

The generic name is an arbitrary combination of letters incorporating the name Andes and the Greek word *iops* (little fish). The gender is masculine.

##### Distribution

Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela.

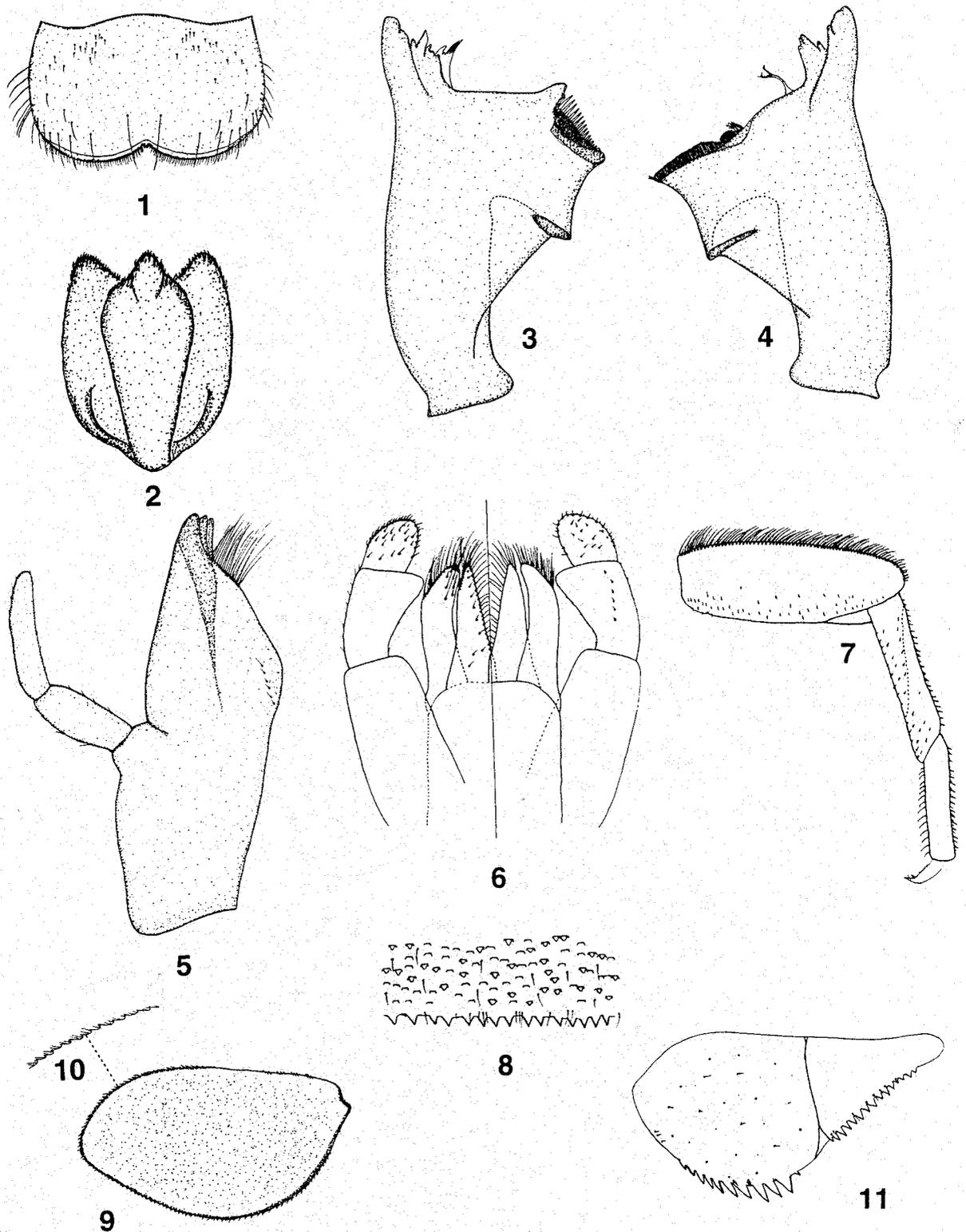
##### Included species

*Andesiops peruvianus* (Ulmer), new combination (type species).

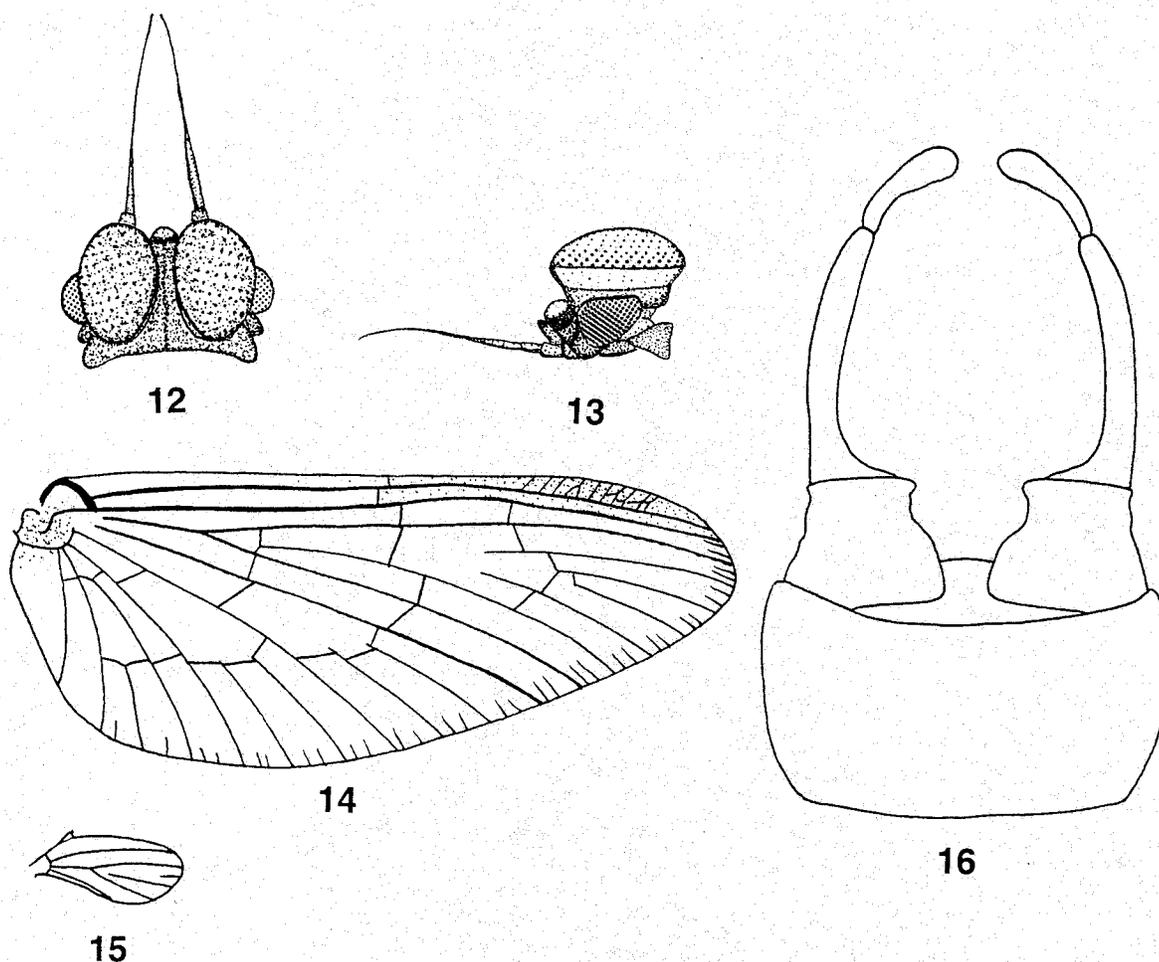
##### Discussion

Larvae of *Andesiops* are distinguished from those of other South American small minnow mayflies by the following combination of characteristics: apically bifid right prostheca (Fig. 4); distomedially produced labial palp segment 2 (Fig. 6); untracheated or poorly tracheated gills (Fig. 9); two rows of denticles on the tarsal claws (Fig. 59); and the medial caudal filament is 0.65–0.70× the length of the cerci. Male adults are distinguished from other South American baetids, except *Deceptiviosa* (see below), by the following combination of characteristics: broadly based and ellipsoidal turbinate eyes (Figs. 12, 13); hindwings with a small costal process in the basal one third and three longitudinal veins, the middle vein being forked (Fig. 15); and elongate and ellipsoidal segment 3 of the genital forceps (Fig. 16).

Larvae of *Andesiops* are generally found at high elevations in relatively fast, cold, well-oxygenated



Figs. 1-11. *Andesiops peruvianus*, larva: 1. labrum (dorsal); 2. hypopharynx; 3. left mandible; 4. right mandible; 5. right maxilla; 6. labium (left-ventral; right-dorsal); 7. left foreleg; 8. detail of tergum 4; 9. gill 4; 10. detail of gill margin; 11. paraproct.



Figs. 12-16. *Andesiops peruvianus*, ♂ adult: 12. head (dorsal); 13. head (lateral); 14. right forewing; 15. right hindwing; 16. genital forceps (ventral).

streams, and consequently show adaptations for such habitats [e.g., poorly tracheated or untracheated gills (Fig. 9), sterna with anterolateral friction pads (similar to Figs. 39, 40), and reduced medial caudal filament]. However, *Andesiops* is also found in Andean valleys in streams with slow to moderate current. We suspect that larvae of *Andesiops* are also apt swimmers because the medial caudal filament is relatively long and setaceous (see, e.g., Hynes, 1970; Edmunds & McCafferty, 1988; Lugo-Ortiz & McCafferty, 1996b).

***Andesiops peruvianus* (Ulmer), new combination**

*Baetis peruvianus* Ulmer, 1920: 53.

*Baetis weiseri* Navás, 1922: 385. New synonym.

**Material examined**

ARGENTINA: Córdoba (Copina, Los Cóndores), Tucumán (Quebradita); BOLIVIA: La Paz (La Paz); CHILE: Aconcagua (Portillo, Valparaíso, Río Blanco), Coquimbo (Río Illapel, Río Caren, Río Golgol), De La Araucanía (Pillaifa), De Los Lagos (Valdivia, Río Chanlelfu, Río Pedregoso), Magallanes (Bahía Mansara), Malleco (Victoria, Río Lonquimay, Estero Huemul, Lago Gualletúe, Río Rucanuco, Río Cautín), Región Metropolitana de Santiago (Río Canelo, Río Aconcagua, San José de Maipo, El Canelo, Los Maitenes, Río Colorado); COLOMBIA: Cundinamarca (Río Barroblanco); ECUADOR: Carchi (Santa Bárbara, Tufiño, Río Bobo), Napo (Río Pappalacta, Baeza, Río Maspa), Pichincha (Barrio de la Libertad, Río Solaya), unknown prov. (Tarqui, Santa Cuenca); PERU: Pasco (San José, Bosque de Tocas),

unknown prov. (Río Chillón, Río Huallaga); VENEZUELA: Mérida (Apartaderos).

#### Larva

*Body length:* 7.0–9.5 mm. Caudal filaments length: 3.0–4.0 mm.

*Head:* Coloration cream to medium brown, with no distinct pattern. Antennae approximately 2.5× length of head capsule. Labrum (Fig. 1) dorsally with submedial pair of long, fine, simple setae and anterior submarginal row of six to seven long, fine, simple setae. Hypopharynx as in Figure 2. Left mandible (Fig. 3) with incisor with six to seven denticles. Right mandible (Fig. 4) with outer set of incisors consisting of broad, apically blunt denticle, inner set with four small denticles. Maxillae (Fig. 5) with five to six fine, simple setae near medial hump; palp segment 1 approximately 0.75× length of segment 2. Labium (Fig. 6) with glossae slightly longer than paraglossae, with abundant fine, simple setae medially, increasing in length apically; paraglossae with abundant long, fine, simple setae apically; palp segment 1 approximately 1.15× length of segments 2 and 3 combined; palp segment 2 with six to seven minute, fine, simple setae dorsally; palp segment 3 approximately 0.55× length of segment 2, with abundant minute, fine, simple setae scattered over surface.

*Thorax:* Coloration cream to medium brown, with no distinct pattern. Hindwingpads present. Legs (Fig. 7) cream to pale yellow-brown; femora with row of long, robust, simple setae dorsally and abundant short, robust, simple setae ventrally; tibiae with short, fine, simple setae dorsally and abundant short, robust, simple setae ventrally; tarsi with abundant short, fine, simple setae dorsally and row of fine, simple setae somewhat increasing in length apically; tarsal claws (Fig. 59) with two rows of denticles with 9–11 denticles each, slightly increasing apically.

*Abdomen:* Coloration cream to medium brown, with no consistent pattern; tergum 2 sometimes with small anteromedial, round, cream marking; tergum 3 sometimes with large sublateral, oblong, cream markings; terga 5 and 8 sometimes paler than other terga. Sterna cream to pale yellow-brown. Terga (Fig. 8) with abundant scale and scale bases and minute, fine, simple setae scattered over surface. Gills (Figs. 9, 10) translucent, with margin usually tinged with brown. Paraprocts (Fig. 11) with 9–10 marginal spines, increasing in size apically; few minute, fine,

simple setae scattered over surface. Caudal filaments pale yellow-brown.

#### Male adult

*Body length:* 5.4–5.7 mm. Forewing length: 5.8–6.2 mm. Hindwing length: 1.4–1.6 mm. Caudal filaments length: 15.0–17.0 mm.

*Head* (Figs. 12, 13): Coloration light yellow-brown to medium brown. Antennae approximately 1.5× length of head capsule; scapes and pedicels medium brown, filament cream to white. Turbinate eyes dark yellow-brown, basally tinged with purple-brown to medium brown specks.

*Thorax:* Coloration dark to medium brown, with cream to light yellow-brown markings laterally and posteriorly. Legs pale brown, becoming paler distally; forefemora approximately 0.70× length of tibiae. Forewings as in Figure 14. Hindwings (Fig. 15) approximately 2.0× longer than wide.

*Abdomen:* Coloration medium brown; segment 1 dark brown; segments 2–6 translucent medium brown; segments 7–10 cream to pale brown. Genitalia as in Figure 16. Caudal filaments white to cream.

#### Female adult

*Body length:* 5.5–5.8 mm. Forewing length: 5.9–6.3 mm. Hindwing length: 1.4–1.6 mm. Caudal filaments length: 15.0–17.0 mm.

*Head:* Coloration medium yellow-brown. Antennae approximately 1.5× length of head capsule; scapes and pedicels medium brown, filament cream to white.

*Thorax:* Coloration dark to medium brown, with cream to light yellow-brown markings laterally and posteriorly. Legs pale brown, becoming paler distally; forefemora subequal to tibiae. Forewings as in Figure 14. Hindwings (Fig. 15) approximately 2.0× longer than wide.

*Abdomen:* Coloration medium yellow-brown to medium brown. Caudal filaments white to cream.

#### Discussion

Larvae of *A. peruvianus* show considerable variation in size and body coloration. However, the setation of the labrum (Fig. 1), mandibular denticulation (Figs. 3, 4), and labial morphology (Fig. 6) are consistent among the many populations studied. Male and female adults tend to be consistent in size and body coloration.

Ulmer (1920) described *A. peruvianus* based on male and female adults. Later, Needham & Murphy (1924) described the larval stage. Berner (1980) gave a more complete description of the larva and male adult and provided additional illustrations. The description and illustrations provided herein incorporate morphological characteristics not included in the descriptions by Ulmer (1920), Needham & Murphy (1924), or Berner (1980).

Navás (1922) described *B. weiseri* from a female subimago from Tucumán Province in Argentina. The figure of one of the hindwings provided by Navás (1922: Fig. 3b), along with his comments indicating that the species is quite similar to *A. peruvianus*, clearly indicates that *B. weiseri* is equivalent to *A. peruvianus*.

### ***Deceptiviosa* Lugo-Ortiz & McCafferty, new genus**

#### **Larva (Fig. 26)**

**Head:** Capsule longer than broad, or broader than long (Fig. 27). Labrum (Figs. 17, 28) broader than long, with relatively shallow anteromedial emargination. Hypopharynx with lingua broadly rounded apically and superlinguae somewhat narrow and apically pointed (Fig. 18), or with lingua with small medial hump apically and superlinguae somewhat narrow and apically rounded (Fig. 29). Left mandible (Fig. 30) with one set of incisors; prosthema apically denticulate. Right mandible (Fig. 31) with two sets of incisors, apically denticulate; prosthema apically bifid. Maxillae (Figs. 19, 32) with crown of galealaciniae with four short, blunt denticles; palps two segmented, not reaching galealaciniae. Labium not compact (Fig. 20) or compact (Fig. 33), with palps three segmented; palp segment 3 narrowly (Fig. 20) or broadly (Fig. 33) rounded.

**Thorax:** Notula with or without setae medially. Legs (Figs. 21, 26, 34) slender and elongate, with dorsal row of long, fine, simple setae; femora without villopore; hindtibiae without subapical paddle-shaped seta; tarsal claws (Fig. 37) with one row of denticles and minute subapical denticle.

**Abdomen:** Somewhat slender. Terga with (Fig. 22) or without (Fig. 38) scale bases; creases present; posterior margin with triangular spines. Sterna (Figs. 39, 40) with anterolateral friction pads. Gills (Figs. 23, 24, 26, 35, 36) on segments 1-7, platelike, marginal-

ly poorly serrate or smooth, poorly tracheated, held dorsolaterally. Paraprocts (Figs. 25, 41) with marginal spines. Cerci with abundant setae laterally and medially; medial caudal filament 0.15-0.60× cerci length, with or without (Fig. 26) fine, simple setae laterally.

#### **Adult**

**Head:** Turbinate eyes (Figs. 42, 43) broadly based, semicircular.

**Thorax:** Forewings (similar to Fig. 14) anastomosed subapically between costa and subcosta, with relatively long double marginal intercalary veins. Hindwings (Fig. 44) with three longitudinal veins, middle vein forked; small costal process in basal one third.

**Abdomen:** Male genital forceps (Fig. 45) three segmented; segment 1 short, subcylindrical; segment 2 long, arched; segment 3 ellipsoidal, approximately 0.46× length of segment 2. Caudal filaments approximately 2.78-3.0× body length.

#### **Etymology**

The generic name is an arbitrary combination of letters derived from the Latin *deceptus*. The gender is feminine.

#### **Distribution**

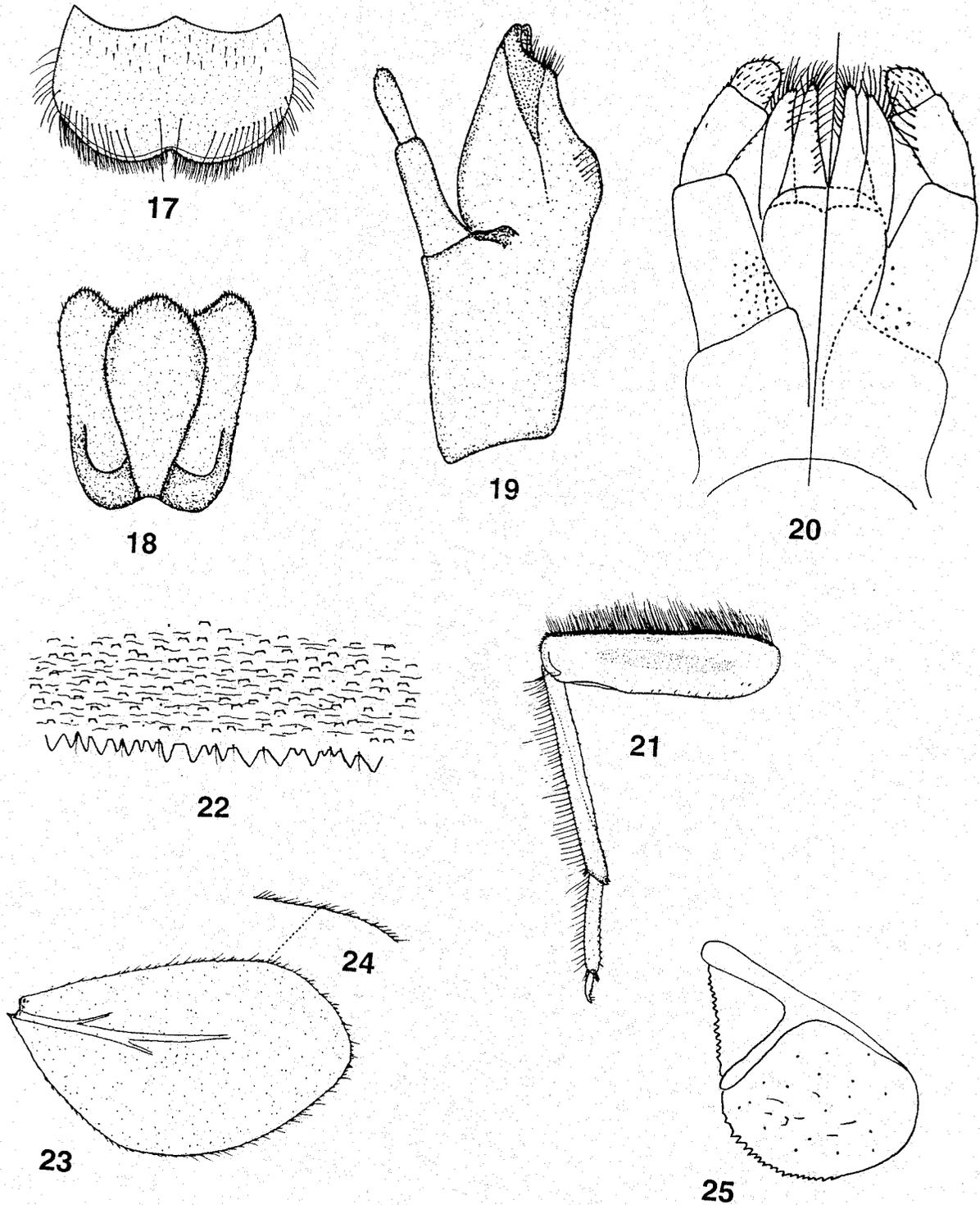
Argentina, Chile.

#### **Included species**

*Deceptiviosa ardua* Lugo-Ortiz & McCafferty, new species; *D. torrens* Lugo-Ortiz & McCafferty, new species (type species).

#### **Discussion**

Larvae of *Deceptiviosa* are distinguished from those of other South American baetids by the following combination of characteristics: apically bifid right prosthema (Fig. 31); slender and elongate legs with a dorsal row of long, fine, simple setae (Figs. 21, 26, 34); tarsal claws with a minute subapical denticle (Fig. 37); creased terga (Figs. 22, 38); and a medial caudal filament that is 0.15-0.60× the length of the cerci. Male adults are distinguished from other South American baetids, except *Andesiops* (see above), by the following combination of characteristics: broadly based and semicircular turbinate eyes (Figs. 42, 43); hindwings with a small costal process in the basal one third and three longitudinal veins, with the



Figs. 17-25. *Deceptiviosa ardua*, new species, larva: 17, labrum (dorsal); 18, hypopharynx; 19, right maxilla; 20, labium (left-ventral; right-dorsal); 21, right foreleg; 22, detail of tergum 4; 23, gill 4; 24, detail of gill margin; 25, paraproct.

Fig. 2

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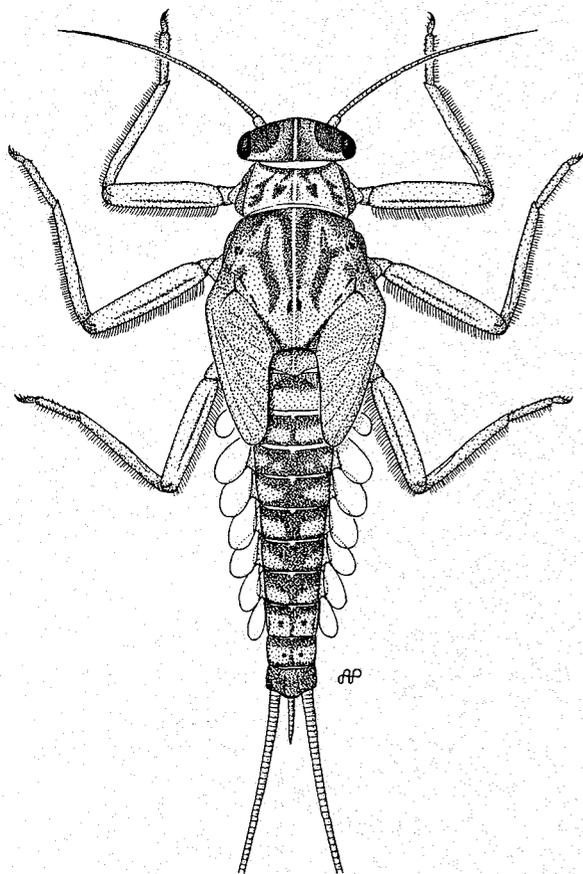


Fig. 26. *Deceptiviosa torrens*, new species, larval habitus.

middle vein being forked (Fig. 44); and segment 3 of the genital forceps is elongate and ellipsoidal (Fig. 45).

As is the case with *Andesiops*, larvae of *Deceptiviosa* are found at high elevations in relatively fast, cold, and well-oxygenated streams and show adaptations for such habitats (see discussion under *Andesiops*). However, larvae of *Deceptiviosa* additionally have long, slender legs with a dorsal row of long, fine, simple setae (Figs. 21, 26, 34) that may aid in keeping purchase in fast streams. In the Andes, in contrast to *Andesiops*, *Deceptiviosa* seems to be confined to high-gradient, high-altitude streams.

Larvae of *Deceptiviosa* are remarkably similar in overall morphology to those of the Holarctic and Oriental genus *Acentrella* Bengtsson and the southern African genus *Demoreptus* Lugo-Ortiz & McCafferty. *Acentrella* and *Demoreptus*, however, possess the villopoire, a patch of setae on the ventral margin of the femora (see Waltz & McCafferty, 1987: Figs. 1,

4, 5, 12, 17), and consequently belong to the *Baetis* complex, a monophyletic grouping with primarily Arctogeian rather than Amphinotic or Neotropical affinities.

***Deceptiviosa ardua* Lugo-Ortiz & McCafferty, new species**

**Type material**

Holotype: Larva, CHILE, De Los Lagos, Fundo Koch, nr Valdivia, 22-X-1957, J. Illies. Paratypes: Four larvae, same data as holotype (mouthparts, forelegs, tergum 4, gills 4, and paraproct of two larvae mounted on slide [medium: Euparal]); CHILE, De Los Lagos, Osorno, Lago Rupanco, 31-X-1957, J. Illies, larva [mouthparts, forelegs, segment 4 mounted on slide (medium: Euparal)] (National Museum of Natural History, Smithsonian Institution, Washington, D. C.).

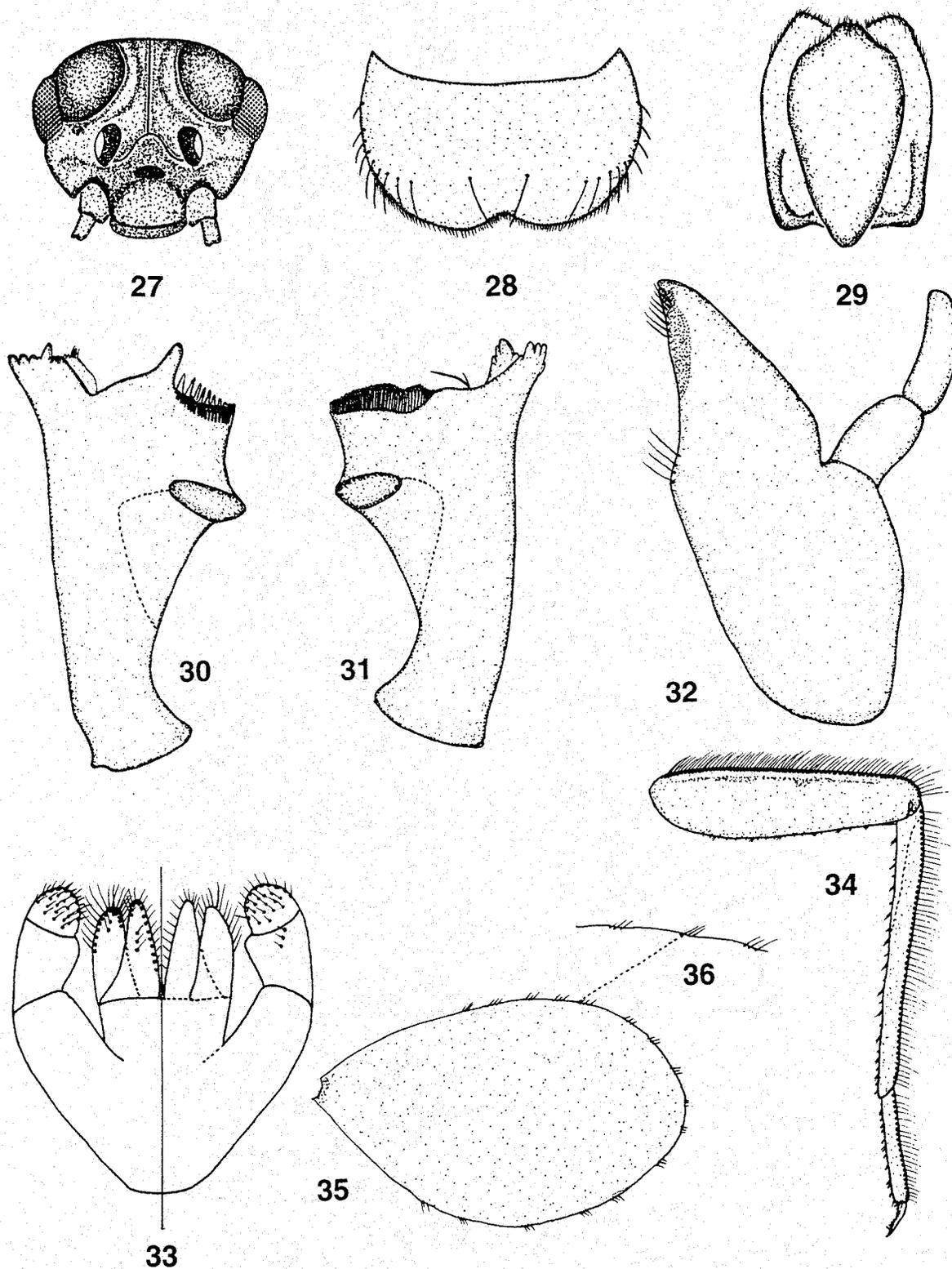
**Additional material examined**

CHILE: Coquimbo (Río Caren). De Los Lagos (Fundo Koch, Fundo Walper, Pillaifa).

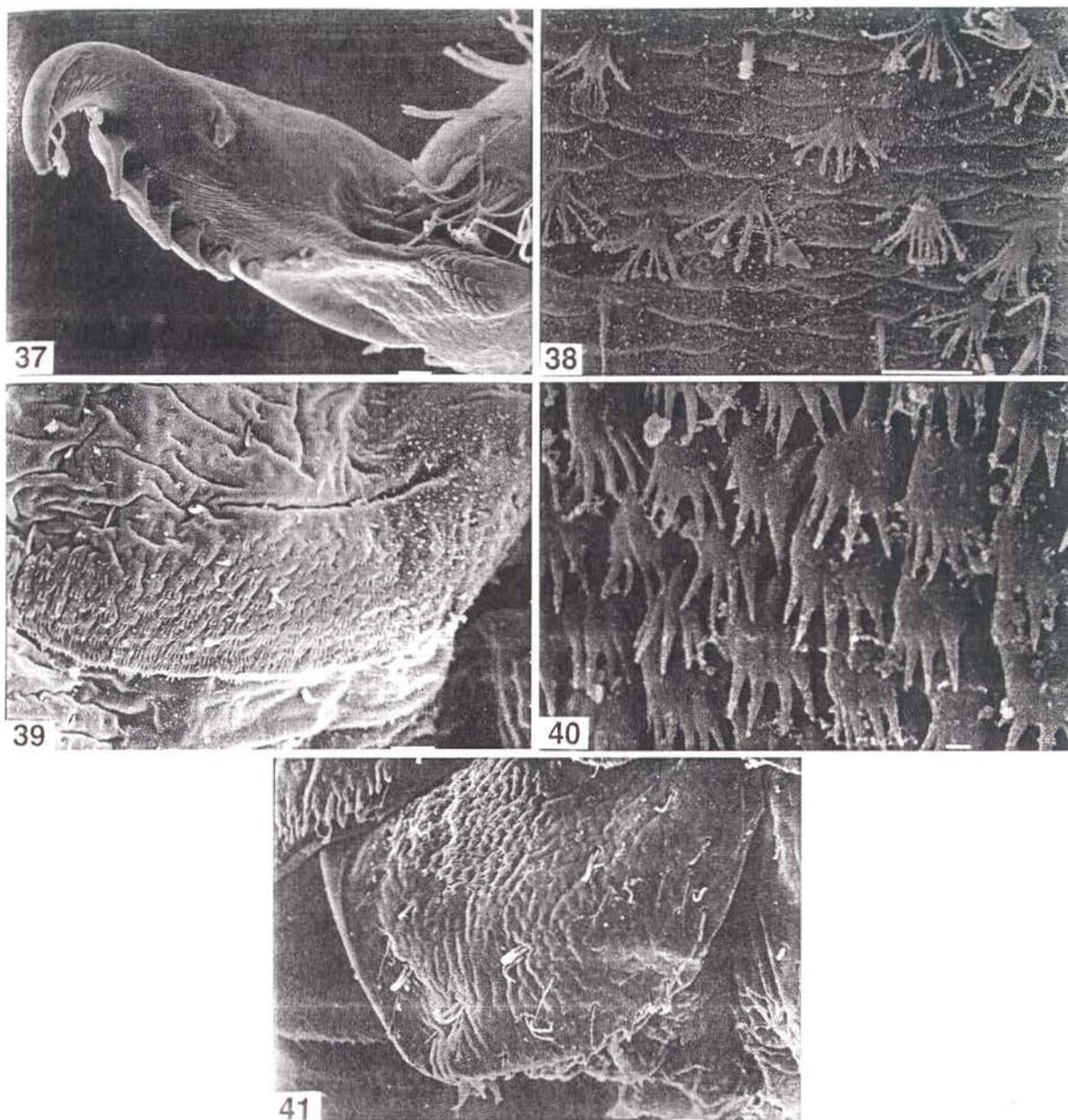
**Larva**

Body length: 6.5–8.2 mm; caudal filaments length: 5.0–5.5 mm.

*Head:* Coloration medium brown to pale yellow-brown. Capsule longer than broad. Antennae approximately 2.5× length of head capsule. Labrum (Fig. 17) with submedial pair of long, fine, simple setae and submarginal row of 10–12 long, fine, simple setae. Hypopharynx as in Figure 18. Left mandible (similar to Fig. 30) with incisor with six to seven denticles. Right mandible (similar to Fig. 31) with outer set of incisors consisting of broad, apically blunt denticle, inner set with four small denticles. Maxillae (Fig. 19) somewhat slender, with five to six fine, simple setae near medial hump; palp segment 1 approximately 1.50× length of segment 2. Labium (Fig. 20) not compact: glossae slightly longer than paraglossae, with fine, simple setae medially and robust, simple setae apically; paraglossae with robust, simple setae apically; palp segment 1 approximately 1.3× length of segments 2 and 3 combined; palp segment 2 with small distomedial projection and four to six fine, simple setae dorsally; palp segment 3 approximately 0.33× length of segment 2, with abundant short, stout, simple setae scattered over surface.



Figs. 27-36. *Deceptiviosa torrens*, new species, larva: 27, head (frontal); 28, labrum (dorsal); 29, hypopharynx; 30, left mandible; 31, right mandible; 32, left maxilla; 33, labium (left-ventral; right-dorsal); 34, left foreleg; 35, gill 4; 36, detail of gill margin.

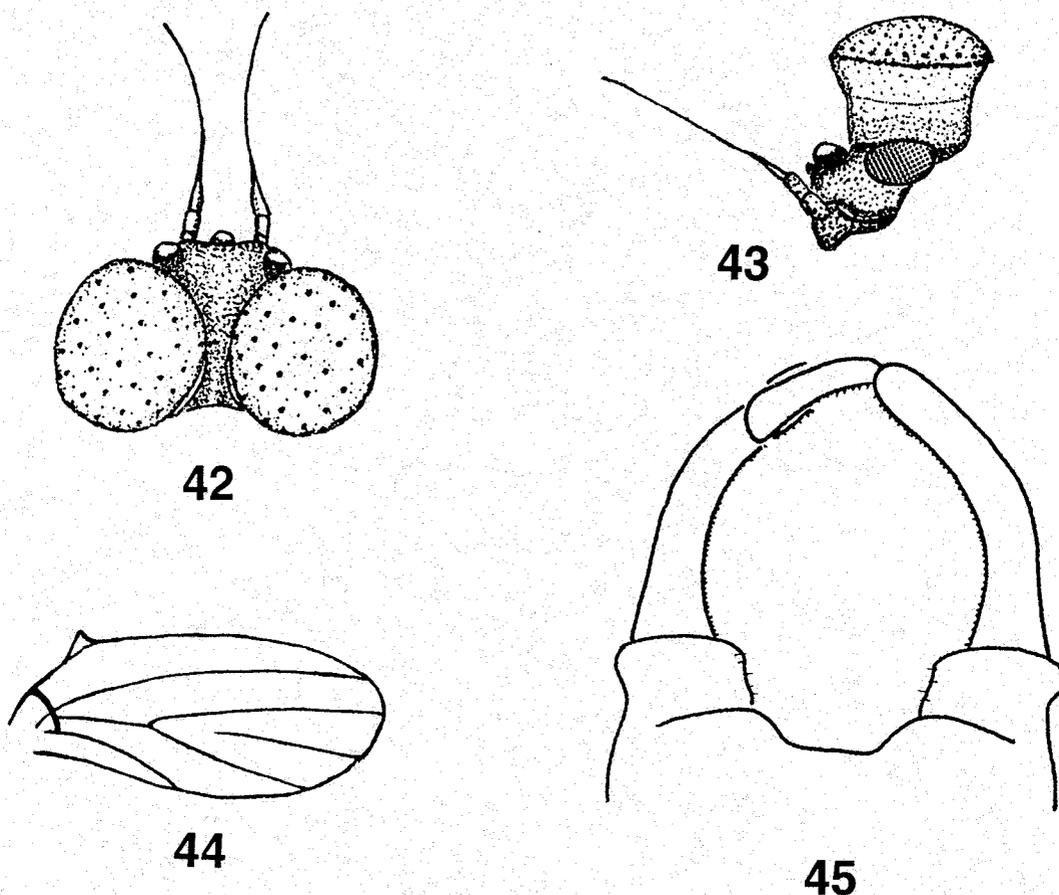


Figs. 37–41. *Deceptiviosa torrens*, new species, larva: 37, tarsal claw (bar = 10  $\mu$ m); 38, detail of tergum 4 (bar = 10  $\mu$ m); 39, friction pad (bar = 10  $\mu$ m); 40, detail of friction pad (bar = 10  $\mu$ m); 41, paraprot (bar = 10  $\mu$ m).

*Thorax:* Coloration dark yellow-brown to medium brown, with complex markings (pronotal pattern similar to Fig. 26). Hindwingpads present. Nota without setae medially. Legs (Fig. 21) pale to dark yellow-brown, with medium brown streak near femoral dorsal margin; tarsal claws (similar to Fig. 37) with five to seven denticles.

*Abdomen:* Coloration medium yellow-brown to dark brown; terga 1–3 and 6–9 medium yellow-

brown, posterior margin dark brown, sometimes with anterior margin light brown and dark brown sublateral markings; tergum 4 medium yellow-brown, with anterior margin light brown and medial light brown band; tergum 5 with large pale yellow-brown to cream crownlike marking; tergum 10 light yellow-brown. Sterna cream to pale yellow-brown. Terga (Fig. 22) with abundant scale bases and minute, fine, simple setae along posterior margin. Gills (Figs. 23,



Figs. 42-45. *Deceptiviosa torrens*, new species. ♂ adult: 42. head (dorsal); 43. head (lateral); 44. right hindwing; 45. genital forceps (ventral).

24) marginally poorly serrate, with abundant minute, fine, simple setae. Paraprocts (Fig. 25) with 16-20 marginal spines, slightly increasing in size apically; few minute, fine, simple setae scattered over surface. Caudal filaments pale to medium yellow-brown; cerci with abundant setae medially; medial caudal filament approximately 0.50-0.60x cerci length.

#### Adult

Unknown.

#### Etymology

The specific epithet is Latin for difficult.

#### Discussion

Larvae of *D. ardua* are distinguished from those of *D. torrens* (see below) by having the head capsule longer than broad; a labrum with a submarginal row

of 10-12 long, fine, simple setae (Fig. 17); relatively slender maxillae (Fig. 19); a labium that is not compact (Fig. 20); bare nota and abdomen; abundant scale bases on the terga (Fig. 22); gills with abundant minute, fine, simple setae marginally and poor serration (Figs. 23, 24); cerci with abundant setae medially; and a medial caudal filament that is 0.50-0.60x the length of the cerci.

#### *Deceptiviosa torrens* Lugo-Ortiz & McCafferty, new species

#### Type material

Holotype: Larva, CHILE, De Los Lagos, Osorno, Río Chanlelfu, Puyehue, 300 m, 22-XI-1963, G. F. Edmunds. Paratypes: 16 larvae, same data as holotype; larva, CHILE, Aconcagua, tributary of Río Blanco, 160 m, 10-XI-1963, G. F. Edmunds; larva, CHILE,

Aconcagua, Río Longotoma, Longotoma, 17-XI-1963, G. F. Edmunds. (Instituto-Fundación Miguel Lillo, Tucumán, Argentina); larva, Coquimbo, Río Illapel, Caren, Hacienda Illapel, 880 m, 13-XI-1963, G. F. Edmunds; five larvae, CHILE, De Los Lagos, Osorno, Río Rahue, 250 m, 20-XI-1963, G. F. Edmunds (mouthparts, forelegs, and tergum 4 of 1 larva mounted on slide [medium: Euparal]); eight larvae, CHILE, De Los Lagos, Río Chanlelfu, Puyehue, 250 m, 21-XI-1963, G. F. Edmunds (seven larvae in National Museum of Natural History, Smithsonian Institution, Washington, D.C.; one in PERC [mouthparts and forelegs mounted on slide (medium: Euparal)]); two exuviae, five larvae, CHILE, De Los Lagos, arroyo, tributary of Río Pedregoso, 8 km N of Villarrica, 28-XI-1963, G. F. Edmunds; five larvae, CHILE, Región Metropolitana de Santiago, Río Arrayán, El Arrayán, 2-XII-1963, G. F. Edmunds; two larvae, CHILE, Magallanes, Río Tres Pasos, 30 km N of Puerto Bories, 5-I-1958, J. Illies; four larvae, CHILE, Malleco, 30 km E of Victoria, 8-XII-1963, G. F. Edmunds.

#### Additional material examined

ARGENTINA: Neuquén (Bariloche); CHILE: Aconcagua (Colliguay), Bío-Bío (Río Mulchen), Coquimbo (Río Illapel, Río Choapa), De Los Lagos (Río Rupanco, Río Rahue, Salto de Laja, Valdivia, Puncapá, Río Chanlelfu, Villarrica, Río Toltén, Río Pedregoso, Río Niblinto), Magallanes (Río Tres Pasos, Última Esperanza, Charrillo de la Piedra, Río Tres Brazos), Malleco (Victoria, Río Bío-Bío, Estero Hueml), Región Metropolitana de Santiago (Río Peuco, Río Volcán, Melipelilla, Río Aconcagua, Río Mapocho, Los Maitenes, El Canelo, Río Arrayán).

#### Larva (Fig. 26)

*Body length:* 6.0-7.0 mm; caudal filaments length: 4.5-5.5 mm.

*Head* (Fig. 27): Coloration medium brown to cream, with complex markings. Capsule broader than long. Antennae approximately 2.0x longer than head capsule, located near ventral margin. Labrum (Fig. 28) with submedial pair of long, fine, simple setae and submarginal row of four to six long, fine, simple setae. Hypopharynx as in Figure 29. Left mandible (Fig. 30) with incisor with six denticles, medial denticle larger than others. Right mandible (Fig. 31) with outer and inner incisors with five denticles each. Maxillae (Fig. 32) with four long, fine, simple setae

near medial hump; palps short and robust, not reaching galealaciniae. Labium (Fig. 33) compact; glossae slightly longer than paraglossae, with abundant fine, simple setae medially, increasing in length medially; palp segment 1 as long as segments 2 and 3 combined; segment 2 with weakly developed distomedial lobe and dorsal row of three to five minute, fine, simple setae; segment 3 rounded, approximately 0.50x length of segment 2.

*Thorax:* Coloration medium brown to cream, with complex markings. Hindwingpads present. Pronotum without setae medially; meso- and metanotum with medial row of long, fine, simple setae. Legs (Figs. 26, 34) pale yellow-brown to cream, with dark yellow-brown streak near dorsal margin; tarsal claws (Fig. 37) with five denticles.

*Abdomen:* Coloration medium brown to cream, markings somewhat variable, generally conforming to pattern in Figure 26. Terga (Fig. 38) creased, with palmate scales and medial row of long, fine, simple setae. Sterna cream to pale yellow-brown. Gills (Fig. 26, 35, 36) marginally smooth, with triads and tetrads of minute, fine, simple setae. Paraprocts (Fig. 41) with basal friction pads and 8-10 minute marginal spines. Caudal filaments pale to medium yellow-brown; cerci bare medially (Fig. 26); medial caudal filament approximately 0.15-0.20x cerci length.

#### Male adult

*Body length:* 4.2-5.0 mm. Forewing length: 5.0-5.5 mm. Hindwing length: 1.2-1.4 mm. Caudal filaments length: 10.0-12.0 mm.

*Head* (Figs. 42, 43): Coloration dark yellow-brown to medium brown. Antennae approximately 1.4x length of head capsule; scapes and pedicels medium brown, filament cream to white. Turbinate eyes dark yellow-brown, basally tinged with purple-brown to medium brown specks, broadly based, semicircular.

*Thorax:* Coloration dark to medium brown, with cream to dark yellow-brown markings laterally and posteriorly. Legs medium yellow-brown, becoming paler distally; forefemora approximately 0.50x length of tibiae. Forewings similar to Figure 14. Hindwings (Fig. 44) approximately 2.4x longer than wide.

*Abdomen:* Coloration medium brown; segment 1 dark brown; segments 2-6 translucent medium brown, usually with dark medium brown hind margin and sublateral, subquadrangular to subtriangular markings; segments 7-10 cream to pale brown. Gen-

italia as in Figure 45. Caudal filaments pale yellow-brown to cream.

#### Female adult

*Body length:* 4.0–5.1 mm. *Forewing length:* 5.0–5.5 mm. *Hindwing length:* 1.2–1.4 mm. *Caudal filaments length:* unknown.

*Head:* Coloration medium yellow-brown. Antennae as in male.

*Thorax:* Coloration medium yellow-brown. Legs with femora approximately as long as tibiae.

*Abdomen:* Coloration medium yellow-brown. Sterna translucent. Tracheal vestiges more conspicuous than in males.

#### Etymology

The specific name is a Latin noun in apposition meaning "swift stream."

#### Discussion

Larvae of *D. torrens* are distinguished from those of *D. ardua* (see above) by having the head capsule broader than long (Fig. 27); the labrum with a submarginal row of four to six long, fine, simple setae (Fig. 28); robust maxillae (Fig. 32); a compact labium (Fig. 33); long, fine, simple setae medially on the mesonotum, metanotum, and abdomen; marginally smooth gills with triads and tetrads of minute, fine, simple setae (Figs. 35, 36); the terga without scale bases and with abundant palmate scales (Fig. 38); medially bare cerci (Fig. 26); and a medial caudal filament that is approximately 0.15–0.20× the length of the cerci.

#### *Nanomis* Lugo-Ortiz & McCafferty, new genus

##### Larva

*Head:* Capsule longer than broad. Labrum (Fig. 46) wider than long, broadly rounded anteriorly, with narrow anteromedial emargination. Hypopharynx (Fig. 47) with lingua with medial hump apically and superlinguae apicolaterally narrow. Left mandible (Fig. 48) with one set of incisors; prosthema robust, apically denticulate. Right mandible (Fig. 49) with two sets of incisors; prosthema apically bifid. Maxillae (Fig. 50) with four short, blunt denticles on crown of galealaciniae; palps two segmented, slightly extending beyond galealaciniae; palp segment 2 apically acute. Labium (Fig. 51) not compact, with palps three segmented; palp segment 3 broadly rounded.

*Thorax:* Nota without setae medially. Legs (Fig. 52) robust, without dorsal row of long, fine, simple setae; femora without villopore; hindtibiae with subapical paddle-shaped seta (Fig. 56); tarsal claws with 1 row of denticles (Figs. 57).

*Abdomen:* Slightly dorsoventrally flattened. Terga (Fig. 53) with abundant scale bases; creases absent; posterior margin smooth. Sterna (similar to Figs. 39, 40) with anterolateral friction pads. Gills (Figs. 54, 55) on segments 1–7, platelike, relatively broad, marginally with small serrations, well-tracheated, held dorsolaterally. Paraprocts (Fig. 58) with marginal spines. Cerci with abundant setae laterally and medially; medial caudal filament approximately 0.80–0.85× cerci length, with abundant fine, simple setae laterally.

##### Adult

Unknown.

#### Etymology

The generic name is an arbitrary combination of letters incorporating the Greek words *nano* (dwarf) and *omis* (fish). The gender is feminine.

#### Distribution

Argentina, Colombia, Ecuador, Peru.

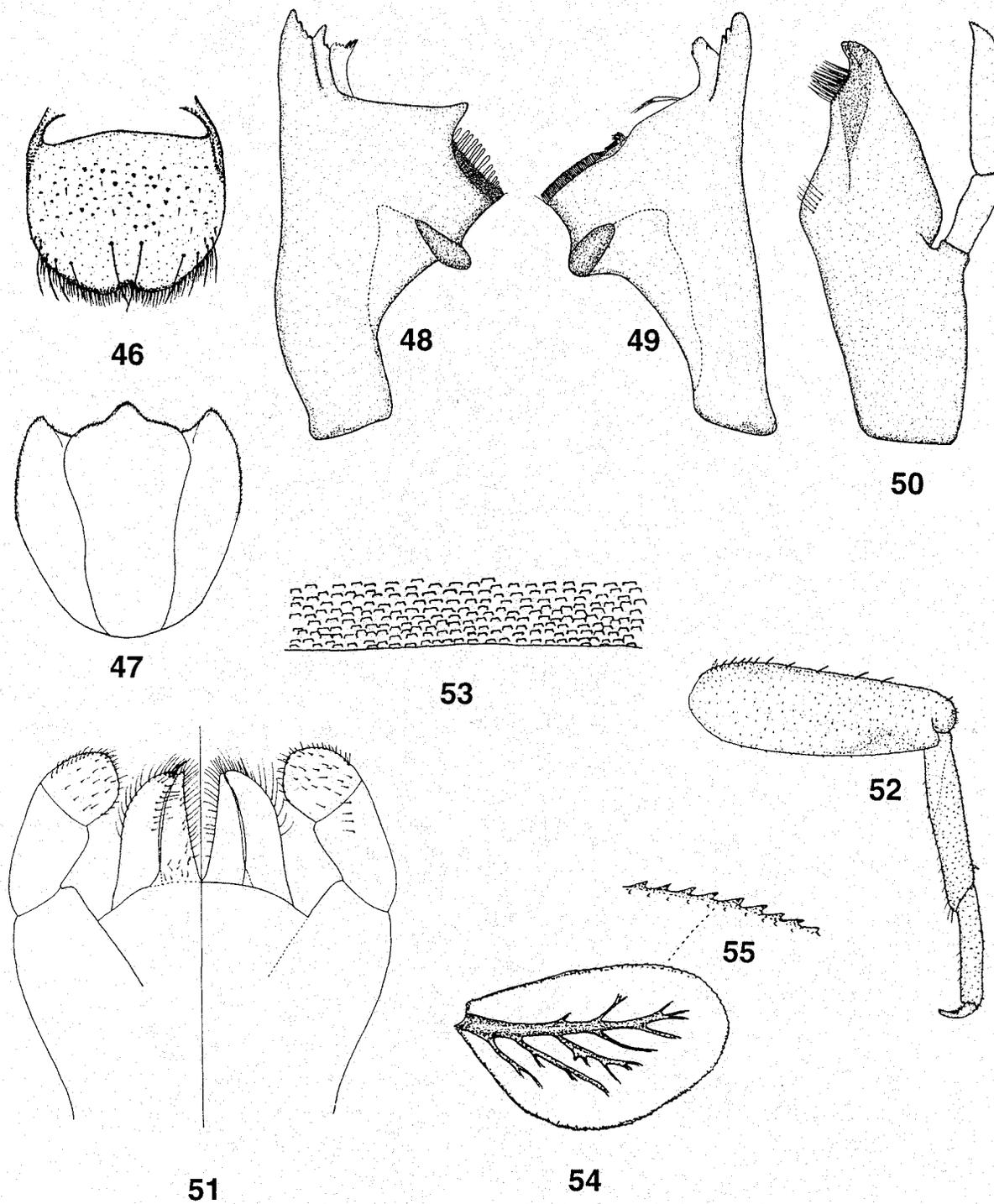
#### Included species

*Nanomis galera* Lugo-Ortiz & McCafferty, new species (type species).

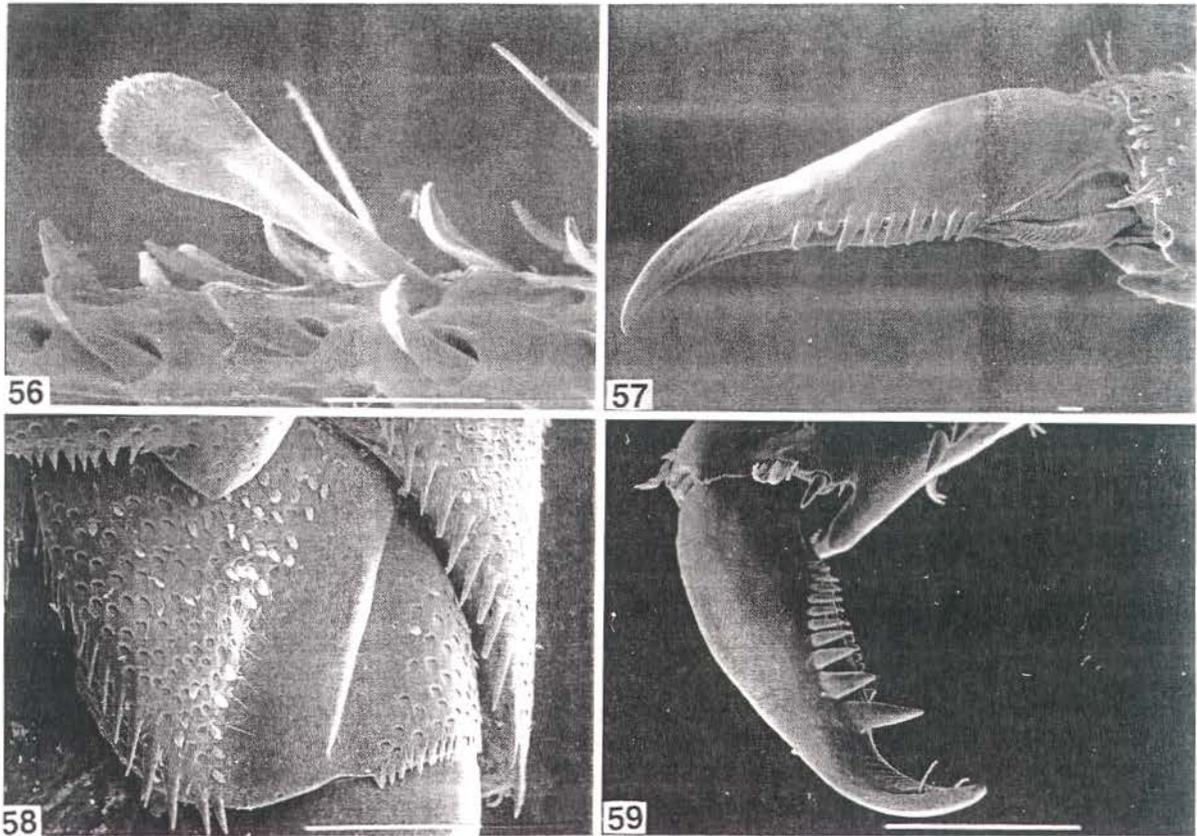
#### Discussion

Larvae of *Nanomis* are distinguished from those of other South American baetids by the following combination of characteristics: apically bifid right prosthema (Fig. 49); apically acute maxillary palp segment 2 (Fig. 50); presence of a subapical paddle-shaped seta on the hindtibiae (Figs. 56); abdominal terga with smooth posterior margin (Fig. 53); the presence of abundant scale bases throughout the entire body surface; and the medial caudal filament is 0.80–0.85× the length of the cerci.

*Nanomis* is found at relatively high altitudes in the Andes, and its distribution appears to be restricted to the central part of the region (see distribution above). The presence of a relatively long medial caudal filament may suggest that larvae can inhabit slower currents than those that typify *Deceptiviosa*, for example.



Figs. 46-55. *Nanomis galera*, new species, larva: 46, labrum (dorsal); 47, hypopharynx; 48, left mandible; 49, right mandible; 50, left maxilla; 51, labium (left-ventral; right-dorsal); 52, left foreleg; 53, detail of tergum 4; 54, gill 4; 55, detail of gill margin.



Figs. 56–59. *Nanomis galera*, new species, and *Andesiops peruvianus*, larvae: 56–58. *Nanomis galera*: 56, hindtibial subapical paddle-shaped seta (bar = 10  $\mu$ m); 57, tarsal claw (bar = 10  $\mu$ m); 58, paraproct (bar = 100  $\mu$ m); 59. *Andesiops peruvianus*: tarsal claw.

We cannot at this time determine the function of the paddle-shaped seta on the hindtibiae (Figs. 52, 56). It is possible, however, that it has a sensory function and that it aids larvae in orienting themselves in the current.

*Nanomis galera* Lugo-Ortiz & McCafferty, new species

**Type material**

Holotype: Larva, ECUADOR, Carchi, Río San Juan, 1.8 km E of Maldonado, 2195 m, 18°C, large, rocky river, 16-VII-1993, Sites, Linit, Nichols. Paratypes: four exuviae, ARGENTINA, Tucumán, stream at Horco Molle, NW of San Miguel de Tucumán, 1800 ft, 25-I-1969, W. L. and J. G. Peters; seven larvae, ECUADOR, Carchi, Río San Juan, 1.8 km E of Maldonado, 2195 m, 18°C, large, rocky river, 16-VII-1993, Sites, Linit, Nichols (four larvae in PERC, three larvae in University of Missouri, Columbia);

six larvae, ECUADOR, Napo, 6.2 km S of Baeza (old town), 1865 m, 16°C, vegetation in small rocky stream, 21-VII-1993, Sites, Linit, Nichols.

**Additional material examined**

ARGENTINA: Córdoba (Copina, Río Chico de Nono, Río Salsacate, Río Soto, Río San Carlos, Río Pichanas), Tucumán (Horco Molle); COLOMBIA: Cundinamarca (El Colegio, Río Dulce, Río Barroblanco, Quebrada Naranjal); Tolima (Quebrada Padilla); ECUADOR: Carchi (Río San Juan), Napo (Baeza), Pichincha (Río Toachi, Río Dos Ríos); PERU: Cuzco (Río Chaupimayo), Huánuco (Río Huallaga).

**Larva**

*Body length:* 7.5–9.0 mm; *caudal filaments length:* 4.5–5.0 mm.

*Head:* Coloration cream to medium brown, with no pattern. Capsule longer than broad. Antennae approximately 2.0 $\times$  length of head capsule. Labrum

(Fig. 46) with submedial pair of long, fine, simple setae and submarginal row of four to five long, fine, simple setae. Hypopharynx as in Figure 47. Left mandible (Fig. 48) with incisor with seven denticles. Right mandible (Fig. 49) with outer set of incisors with three denticles, inner set with four denticles. Maxillae (Fig. 50) with five to six fine, simple setae near medial hump; palp segment 1 approximately  $0.53\times$  length of segment 2; segment 2 apically narrow. Labium (Fig. 51) with glossae and paraglossae equal in length, with fine, simple setae medially and robust, simple setae apically; paraglossae with robust, simple setae apically and fine, simple setae laterally; palp segment 1 approximately  $0.81\times$  length of segments 2 and 3 combined; palp segment 2 without distomedial lobe and with four to five minute, fine, simple setae dorsally; palp segment 3 approximately  $0.71\times$  length of segment 2, with abundant short, fine, simple setae scattered over surface.

**Thorax:** Coloration medium yellow-brown to medium brown, with complex markings. Hindwingpads present. Legs (Figs. 52) medium yellow-brown to medium brown; femora with dorsal row of 12-14 long, robust, simple setae; tibiae with ventral row of fine, simple setae, increasing in length apically, and with dorsal row of minute, fine, simple setae; tarsal claws (Fig. 57) with row of eight to nine denticles, slightly increasing in length apically.

**Abdomen:** Coloration medium yellow-brown to medium brown, with highly variable markings; terga 1-8 or 1-9 usually with faint cream to light yellow-brown medial streak; terga 3-5 usually with large crownlike markings. Sterna cream to medium yellow-brown. Terga (Fig. 53) with abundant scale bases. Gills (Figs. 54, 55) translucent, well tracheated, with margin usually tinged with brown. Paraprocts (Fig. 58) with 10-12 acute marginal spines, slightly increasing in length apically; abundant scale bases and few scales and minute, fine, simple setae scattered over surface. Caudal filaments cream to pale yellow-brown, with broad medium brown band in middle.

#### Adult

Unknown.

#### Etymology

The specific epithet is Greek for cheerful.

#### Discussion

Although no other species of *Nanomis* are known at this time, we expect the setation of the labrum (Fig. 46), denticulation of the mandibles (Figs. 48, 49), and labial morphology (Fig. 51) to be characteristic of *N. galera*.

#### GENERIC RELATIONSHIPS

*Andesiops*, *Deceptiviosa*, and *Nanomis* are confined to the Andes and Patagonia. Their larvae are primarily found in cool-water streams at high altitudes or temperate latitudes, and show similar adaptations for that type of habitat (see discussion under each genus). Significantly, larvae of the three genera have an apically bifid right prostheca (Figs. 4, 31, 49). That morphological feature, along with the essentially restricted distribution, suggests that *Andesiops*, *Deceptiviosa*, and *Nanomis* are related. Moreover, the apically bifid right prostheca is also present in the Australian genus *Edmundsiops* Lugo-Ortiz & McCafferty (Lugo-Ortiz & McCafferty, 1999). If that morphological feature proves to be a valid synapomorphy for the four genera, then it would indicate that they are derived from a Transantarctic ancestor. Furthermore, if that is the case, then it is important to note that these baetids do not show the exact Amphiphotic distribution pattern as such Siphonuroid or Heptagenoid families as Nesamelitidae, Rallidentidae, and Coloburiscidae (i.e., Australia, New Zealand, and South America confined to Chile/Patagonia). The temperate South American baetids in question have demonstrated a propensity for northward dispersal since the isolation of South America from Antarctica that has been facilitated by the much later appearance of high-gradient, cool-water streams that formed in association with the Andean orogeny. Notably, the wide range of *Andesiops peruvianus* in South America is quite analogous to that of the widespread *Baetis tricaudatus* Dodds in temperate North America.

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